't Hooft Cellular Automaton – Deterministic Substrate of Quantum Mechanics

Scope Note
This work presents a conceptual and mathematical reconstruction framework compatible with deterministic cellular-automaton interpretations of quantum mechanics; it does not propose a new fundamental physical law, modification of quantum dynamics, or experimentally falsifiable prediction beyond existing formulations.

Emergent Reconstruction Map
The following equation is presented as an Emergent Reconstruction Map, not as a fundamental dynamical law. It defines a formal mapping from a deterministic substrate of ontic (beable) states to an effective quantum state description. Given a deterministic update rule T, a defined equivalence relation over beable configurations with cardinality N[alpha], and an embedding into Hilbert space, the emergent quantum state is reconstructed as a weighted superposition over beable trajectories. Probabilistic behavior arises solely from coarse-graining over unresolved degrees of freedom.

Core Equation (ASCII)
|Psi(t)> = sum_alpha sqrt(N[alpha] / N_total) * exp(i * S[alpha] / hbar) * |alpha(t)>_beable

Scope and Limits
This document is restricted to a formal reconstruction of emergent quantum state descriptions from an assumed deterministic substrate. No claim is made that the reconstruction is unique, complete, or inevitable. The existence and structure of the automaton are treated as external inputs.

Mathematical Status
All equations are formal constructions. No convergence proofs or uniqueness theorems are claimed unless explicitly stated. Continuum limits are used in the standard formal sense.

Interpretation Boundary
Interpretive language carries no metaphysical commitment. The formal content is independent of philosophical interpretation.

Relationship to Established Theory
This framework is compatible with standard quantum mechanics and does not replace or modify established theory.

Archival Classification
Conceptual Framework / Interpretive Reconstruction